

**Appl. No. 09/580,343**  
**Amdt. dated September 10, 2004**  
**Reply to Office Action of June 10, 2004**

### **REMARKS/ARGUMENTS**

Reconsideration of this application is respectfully requested.

Claims 1, 4, 6-13, 16-28, 30-44, 47, 49-56, and 59 through 125 are pending in the application with claims 4, 7, 8, 10-13, 18-28, 47, 50, 51, 53-56, 61-72, 74, and 90-121 having been withdrawn from consideration, claims 2, 3, 5, 14, 15, 29, 45, 46, 48, 57, and 58 having been canceled, claims 1 and 44 having been currently amended, and new claims 124 and 125 having been added.

Claims 14 and 57 have been objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to limit the subject matter of a previous claim. Applicants have been required to cancel the claims, or amend the claims to place the claims in proper dependent form, or rewrite the claims in independent form. According to the Examiner, "The structures set forth for component A in claims 14 and 57 are not within the scope of the structures set forth in the claims from which they depend." Claims 14 and 57 have been canceled. New claims 124 and 125 are former claims 14 and 57, respectively, rewritten in independent form.

Accordingly, it is requested that the objection to claims 14 and 57 under 37 CFR 1.75(c), as being of improper dependent form for failing to limit the subject matter of a previous claim be withdrawn.

The problem solved by the present invention is how to inhibit the unwanted growth of living polymer in vinyl aromatic monomers. In certain situations, particularly where nitroxyl compounds were used to inhibit polymerization of monomer, users of the vinyl aromatic

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monomers had found that living polymer had formed and had continued to grow, sometimes growing to masses of significant size. Applicants set out to find a means whereby such growth could be inhibited. They found that the addition of an inhibitor that is a hydrogen donor or electron acceptor would alleviate the problem. One compound, 2,4-dinitro-6-sec-butylphenol, was found to be particularly useful, but that other inhibitors are also operable.

The problem solved by their invention was not considered, and probably not faced, by the patentees of the art cited by the Examiner.

Claims 1, 6, 9, 44, 49., 52, 73, 75, 122, and 123 have been rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Sutoris et al. (WO 97/46504-A1, as evidenced by U.S. Patent No. 6,143,205-A).

Claims 30-43, and 76-89 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sutoris et al.

Claims 16, 17, 59 and 60 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sutoris et al. and further in view of Odian and Quintens et al. (U.S. Patent No. 5,372,924) and Rosenkranz et al. (U.S. Patent No. 4,053,504).

Sutoris et al. disclose mixtures that contain (A) vinyl-containing monomers, and (B) an effective amount of a mixture inhibiting the premature polymerization of the vinyl-containing monomers during the purification or distillation and containing (i) from 0.05 to 4.5% by weight, based on the total mixture (B), of at least one N-oxyl compound of a secondary amine which carries no hydrogen atoms on the  $\alpha$ -carbon atoms and (ii) from 99.95 to 95.5% by weight, based on the total mixture (B), of at least one nitro compound, and the use of the

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mixture (B) for inhibiting the premature polymerization of monomers.

Quintens et al. disclose antistatically treated plastic moldings which contain two layers on the surface to be antistatically treated, the layer situated nearer the plastic surface being an antistatic layer and the more remote layer being a protective layer of a radiation-curing coating composition which is cured by exposure to ionizing radiation, are distinguished by antistatic properties and surface properties.

Rosenkranz et al. disclose that stabilized acrylic acid esters of polyhydric alcohols which contain as stabilizers polymerization inhibitors including small amounts of compounds of the styrene type show a non-reduced polymerization reactivity.

Odian appears to be a review article relating to the suppression of the polymerization of monomers.

According to the Examiner:

"Claims 1, 6, 9, and 122 require adding the elected inhibitor, DNBP, to a mixture of vinyl aromatic polymer (which was formed in the presence of an inhibitor of the class nitroxyl) and vinyl aromatic monomer. These claims encompass methods in which the forming of polymer may have occurred in the presence of DNBP or not, thus the adding of DNBP appears to encompass adding make-up DNBP inhibitor to a stream which has had the inhibitors) depleted, such as in a distillation/purification stream.

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Claims 44, 49, 52, 73, 75, and 123 require adding the elected inhibitor, DNBP, and a nitroxyl inhibitor to a mixture of vinyl aromatic polymer (which was formed in the presence of an inhibitor of the class nitroxyl) and vinyl aromatic monomer. These claims encompass methods in which the forming of polymer may have occurred in the presence of DNBP or not, thus the adding of DNBP plus nitroxyl appears to encompass adding make-up DNBP/nitroxyl inhibitor to a stream which has had the inhibitors) depleted, such as in a distillation/purification stream."

The Examiner's characterization of the polymer referred to in the claims as simply a vinyl aromatic polymer is inaccurate. All of the claims pending in the application describe the polymer as a "*living* vinyl aromatic polymer."

Both the inhibitors of Sutoris et al. and the hydrogen donors of the present invention can be used to inhibit the polymerization of ethylenically unsaturated monomers. However, a key difference between the disclosure of Sutoris et al. and the basis of the currently claimed invention lies in the *new use* of the claimed hydrogen donors as *anti-growth agents*, i.e., agents that prevent the growth of living polymer that is sometimes, but certainly not always, present in monomer preparation systems. Such growth can occur under the same conditions as the polymerization conditions in the Sutoris et al. patent, but there must also be present a *seed capable of growing*, i.e., the living polymer, in order to have growth possible. The method of inhibiting growth is clearly not the same as the method of inhibiting premature polymerization, as described by Sutoris et al., as shown by the performance of nitroxyls alone. Nitroxyls alone

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are highly effective in preventing premature polymerization, as is seen in various literature and patent references; however, nitroxyls alone do not prevent *living polymer* growth, as illustrated in our testing. (See the Examples of the present application, in particular, the data of Tables 1 through 4.) Thus, use as a polymerization inhibitor does not establish use as a *living polymer* anti-growth agent. These are two different uses for known compounds that can occur under similar conditions; however, the growth condition requires the presence of a seed capable of growth, the inhibitor-terminated polymer chain capable of participating in a dynamic equilibrium between a dormant species and an active polymer chain (living polymer) of the present claims. Neither living polymer, per se, nor any means for preventing its growth once it is present is disclosed or suggested by Sutoris et al. either alone or in combination with Odian, Quintens et al., and/or Rosenkranz et al.

Further, in view of the Examiner's speculation that "the forming of polymer may have occurred in the presence of DNBP", Applicants have amended all the formerly pending claims remaining under consideration in the application to clarify that the living vinyl aromatic polymer whose growth is inhibited according to the present invention was not only previously formed in the presence of a nitroxyl inhibitor in admixture with vinyl aromatic monomer, but also in the *absence* of the claimed inhibitor, e.g., DNBP. New claims 124 and 125 also include this feature.

Accordingly, it is requested that the rejections of:

(A) claims 1, 6, 9, 44, 49., 52, 73, 75, 122, and 123 under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Sutoris et al.;

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(B) claims 30-43, and 76-89 under 35 U.S.C. 103(a) as being unpatentable over Sutoris et al.; and

(C) claims 16, 17, 59 and 60 under 35 U.S.C. 103(a) as being unpatentable over Sutoris et al. and further in view of Odian and Quintens et al. and Rosenkranz et al. be withdrawn.

Claims 1, 6, 9, 30-44, 49, 52, 73, 75-89, 122, and 123 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Winter et al. (U.S. Patent No. 5,254,760) alone or in view of Foord (U.S. Patent No. 2,225,471) and Hyde et al. (U.S. Patent No. 5,910,232-A).

Claims 16, 17, 59 and 60 are rejected under 35 U.S.C. 103(a) as being unpatentable over Winter et al. alone or in view of Foord and Hyde et al., and further in view of Odian and Quintens et al. and Rosenkranz et al.

Winter et al. disclose that the polymerization of a vinyl aromatic compound, such as styrene, during distillation or purification is inhibited by the presence of at least one stable nitroxyl compound together with at least one aromatic nitro compound.

Foord discloses, *inter alia*, that a distinction must be made between the term "inhibitor", which he uses to denote a substance that, when added to styrene, produces an appreciable increase in the natural short time induction period of the styrene, and the term "retarding agent", which he uses to denote a substance that, when added to the styrene, reduces the rate at which the polymerization takes place once it has started.

Hyde et al. disclose an improvement in inhibition performance in styrene processing through the addition of a stable nitroxide free radical compound to the styrene feed and to the

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reflux of at least one column.

The disclosures of Oadian, Quintens et al., and Rosenkranz et al. have been described above.

According to the Examiner:

"Claims 1, 6, 9, and 122 require adding the elected inhibitor, DNBP, to a mixture of vinyl aromatic polymer (which was formed in the presence of an inhibitor of the class nitroxyl) and vinyl aromatic monomer; with claims 30-43 having additional limitations: that there are impurities, that the impurities arise from the monomer production or purification, that the polymer is either soluble or insoluble with respect to the monomer, that the monomers are undergoing purification by distillation. These claims encompass methods in which the forming of polymer may have occurred in the presence of DNBP or not, thus the adding of DNBP appears to encompass adding make-up DNBP inhibitor to a stream which has had the inhibitors) depleted, such as in a distillation/purification stream.

Claims 44, 49, 52, 73, 75, and 123 require adding the elected inhibitor, DNBP, and a nitroxyl inhibitor to a mixture of vinyl aromatic polymer (which was formed in the presence of an inhibitor of the class nitroxyl) and vinyl aromatic monomer; with claims 76-89 having additional limitations: that there are impurities, that the impurities arise from the monomer production or purification, that the polymer is either soluble or insoluble with respect to the

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monomer, that the monomers are undergoing purification by distillation. These claims encompass methods in which the forming of polymer may have occurred in the presence of DNBP or not, thus the adding of DNBP plus nitroxyl appears to encompass adding make-up DNBP/nitroxyl inhibitor to a stream which has had the inhibitors) depleted, such as in a distillation/purification stream."

The amended claims of the application are directed to the use of a particularly defined class of hydrogen donor for inhibiting the polymer growth of living vinyl aromatic polymer that had previously been formed in the presence of a nitroxyl inhibitor in admixture with vinyl aromatic monomer(s) and in the absence of said hydrogen donor.

Again, the Examiner's characterization of the polymer referred to in the claims as simply a vinyl aromatic polymer is inaccurate. All of the claims pending in the application describe the polymer as a "*living* vinyl aromatic polymer."

Both the inhibitors of Winter et al. and the hydrogen-donor inhibitors of the present invention, as noted above, can be used to inhibit the polymerization of ethylenically unsaturated monomers. However, a key difference between the disclosure of Winter et al. and the basis of the currently claimed invention lies in the *new use* of the claimed hydrogen-donor inhibitors as *anti-growth agents*, i.e., agents that prevent the growth of living polymer that is sometimes, but certainly not always, present in monomer preparation systems. Such growth can occur under the same conditions as the polymerization conditions in the Winter et al. patent, but there must also be present a *seed capable of growing*, i.e., the living vinyl aromatic polymer, in order to have growth possible. The method of inhibiting growth is clearly not the



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same as the method of inhibiting premature polymerization, as described by Winter et al., as shown by the performance of nitroxyls alone. Nitroxyls alone are highly effective in preventing premature polymerization, as is seen in various literature and patent references; however, nitroxyls alone do not prevent living polymer growth, as illustrated in our testing. (See the Examples of the present application, in particular, the data of Tables 1 through 4.) Thus, use as a polymerization inhibitor does not establish use as a living vinyl aromatic polymer anti-growth agent. These are two different uses for known compounds that can occur under similar conditions; however, the growth condition requires the presence of a seed capable of growth, the inhibitor-terminated polymer chain capable of participating in a dynamic equilibrium between a dormant species and an active polymer chain (living polymer) of the present claims. Neither living vinyl aromatic polymer, per se, nor any means for preventing its growth once it is present is disclosed or suggested by Winter et al. either alone or in combination with Foord, Hyde et al., Odian, Quintens et al., and/or Rosenkranz et al.

Further, in view of the Examiner's speculation that "the forming of polymer may have occurred in the presence of DNBP" and as pointed out above, Applicants have amended all the formerly pending claims remaining under consideration in the application to clarify that the living vinyl aromatic polymer whose growth is inhibited according to the present invention was not only previously formed in the presence of a nitroxyl inhibitor in admixture with vinyl aromatic monomer, but also in the *absence* of the claimed inhibitor, e.g., DNBP. New claims 124 and 125 also include this feature.

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Accordingly, it is requested that the rejections of:

(A) claims 1, 6, 9, 30-44, 49, 52, 73, 75-89, 122, and 123 under 35 U.S.C. 103(a) as being unpatentable over Winter et al. alone or in view of Foord and Hyde et al.; and

(B) claims 16, 17, 59 and 60 35 U.S.C. 103(a) as being unpatentable over Winter et al. alone or in view of Foord and Hyde et al., and further in view of Odian and Quintens et al. and Rosenkranz et al.

be withdrawn.


It is submitted that none of the cited references, alone or in combination, disclose the problem solved by the present invention or its solution, which solution lies in the new use for the claimed hydrogen donors.

In view of the foregoing, it is submitted that this application is now in condition for allowance and an early Office Action to that end is earnestly solicited.

Respectfully submitted,

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